

```

function y=ti(receiver,signal,pattern)

%receiver=subscriber
%    hub
%    repeater
%    backbone
%
%signal=am
%    fm
%    52 Mbps
%
%pattern=itu
%    supplied

global freq lambda step_size

global lmds_name lmds_file cell_radius lmds_rx_peak_gain lmds_eirp
global lmds_phi lmds_rx_gain allowed_cnir
global lmds_bw_mhz lmds_rx_noise_temp_k lmds_case

lmds_name='Texas Instruments';
cell_radius=5/1.6093; %miles
lmds_phi=0:step_size:180;

if strcmp(receiver,'subscriber')==1; r='S';
    lmds_rx_peak_gain=34;
    if strcmp(pattern,'supplied')==1
        lmds_disc=-30*ones(size(lmds_phi));
        phi1=12;
        phi2=15;
        g1=-28;
        g2=-30;
        slope=(g2-g1)/(phi2-phi1);
        range=phi1/step_size+1:phi2/step_size+1;
        lmds_disc(range)=g1+slope*((range-1)*step_size-phi1);
        phi1=9;
        phi2=12;
        g1=-28;
        g2=-28;
        slope=(g2-g1)/(phi2-phi1);
        range=phi1/step_size+1:phi2/step_size+1;
        lmds_disc(range)=g1+slope*((range-1)*step_size-phi1);
        phi1=5;
        phi2=9;
        g1=-22;
        g2=-28;
        slope=(g2-g1)/(phi2-phi1);
        range=phi1/step_size+1:phi2/step_size+1;
        lmds_disc(range)=g1+slope*((range-1)*step_size-phi1);
        phi1=2;
        phi2=5;
    end
end

```

```

g1=0;
g2=-22;
slope=(g2-g1)/(phi2-phi1);
range=phi1/step_size+1:phi2/step_size+1;
lmds_disc(range)=g1+slope*((range-1)*step_size-phi1);
phi1=0;
phi2=2;
g1=0;
g2=0;
slope=(g2-g1)/(phi2-phi1);
range=phi1/step_size+1:phi2/step_size+1;
lmds_disc(range)=g1+slope*((range-1)*step_size-phi1);
lmds_rx_gain=lmds_rx_peak_gain+lmds_disc;
end
if strcmp(signal,'fm')==1; s='F';
lmds_eirp=0;
allowed_cnir=18;
lmds_bw_mhz=17;
lmds_rx_noise_temp_k=1585;
end
if strcmp(signal,'52 Mbps')==1; s='D';
lmds_eirp=0;
allowed_cnir=13;
lmds_bw_mhz=52;
lmds_rx_noise_temp_k=1585;
end
end
if strcmp(receiver,'hub')==1; r='H';
lmds_rx_peak_gain=12;
if strcmp(pattern,'supplied')==1
    lmds_rx_gain=lmds_rx_peak_gain*ones(size(lmds_phi));
end
if strcmp(signal,'52 Mbps')==1; s='D';
lmds_eirp=22;
allowed_cnir=13;
lmds_bw_mhz=52;
lmds_rx_noise_temp_k=1585;
end
end
if strcmp(pattern,'itu')==1
    lmds_rx_gain=gainitu(0,0,lmds_rx_peak_gain,60,lmds_phi);
end
lmds_case=str2mat(receiver,signal,num2str(lmds_bw_mhz),pattern);
lmds_file=['T' r s];
return

```

```

function y=acts(terminal,signal,pattern,elevation_angle)

%terminal=usat
%          hdrt
%
%signal=4.8 kbps
%          622 Mbps
%
%pattern=itu
%          supplied

global freq lambda step_size

global fss_name fss_file fss_el_angle fss_phi fss_tx_peak_gain
global fss_tx_gain fss_tx_power_per_channel fss_bw_mhz
global fss_gain_theta fss_eirp fss_case

fss_name='Acts';
fss_phi=0:step_size:180;

if strcmp(terminal,'usat')==1; t='L';
fss_tx_peak_gain=36.8;
if strcmp(pattern,'supplied')==1
    fss_tx_gain=gainitu(0,0,fss_tx_peak_gain,60,fss_phi);
end
if strcmp(signal,'4.8 kbps')==1
    fss_tx_power_per_channel=-8.7;
    fss_bw_mhz=.0048;
end
end
if strcmp(terminal,'hdrt')==1; t='H';
fss_tx_peak_gain=55.8;
if strcmp(pattern,'supplied')==1
    fss_tx_gain=gainitu(0,0,fss_tx_peak_gain,60,fss_phi);
    phi1=100;
    phi2=180;
    phi=phi1:step_size:phi2;
    fss_tx_gain(phi1/step_size+1:phi2/step_size+1)=-15*ones(size(phi));
    phi1=75;
    phi2=100;
    phi=phi1:step_size:phi2;
    fss_tx_gain(phi1/step_size+1:phi2/step_size+1)=-6*ones(size(phi));
    phi1=48;
    phi2=75;
    phi=phi1:step_size:phi2;
    fss_tx_gain(phi1/step_size+1:phi2/step_size+1)=-10*ones(size(phi));
    phi1=9;
    phi2=48;
end

```

```
phi=phi1:step_size:phi2;
fss_tx_gain(phi1/step_size+1:phi2/step_size+1)=32-25*log10(phi);
end
if strcmp(signal,'622 Mbps')==1
    fss_tx_power_per_channel=22;
    fss_bw_mhz=900;
end
end

if strcmp(pattern,'itu')==1
    fss_tx_gain=gainitu(0,0,fss_tx_peak_gain,60,fss_phi);
end

fss_el_angle=elevation_angle;
fss_gain_theta=fss_tx_gain(elevation_angle/step_size+1);
fss_eirp=fss_tx_power_per_channel+fss_gain_theta;

fss_case=str2mat(terminal,signal,num2str(fss_bw_mhz),pattern,num2str
(elevation_angle));
fss_file=['A' t num2str(elevation_angle)];

return
```

```

function y=teledes(terminal,signal,pattern,elevation_angle)

%terminal=tst
%          tgt
%
%signal=t1
%          oc24
%
%pattern=itu
%          supplied

global freq lambda step_size

global fss_name fss_file fss_el_angle fss_phi fss_tx_peak_gain
global fss_tx_gain fss_tx_power_per_channel fss_bw_mhz
global fss_gain_theta fss_eirp fss_case fss_power_control

fss_name='Teledesic';
fss_phi=0:step_size:180;

if strcmp(terminal,'tst')==1; t='L';
  fss_tx_peak_gain=36;
  fss_power_control=15;
  if strcmp(pattern,'supplied')==1
    fss_tx_gain=
  end
  if strcmp(signal,'t1')==1
    fss_tx_power_per_channel=.84;
    fss_bw_mhz=26.5;
  end
end
if strcmp(terminal,'tgt')==1; t='H';
  fss_tx_peak_gain=50;
  if strcmp(pattern,'supplied')==1
    fss_tx_gain=
  end
  if strcmp(signal,'oc24')==1
    fss_tx_power_per_channel=-.177;
    fss_bw_mhz=800;
  end
end

if strcmp(pattern,'itu')==1
  fss_tx_gain=gainitu(0,0,fss_tx_peak_gain,60,fss_phi);
end

fss_el_angle=elevation_angle;
fss_gain_theta=fss_tx_gain(elevation_angle/step_size+1);
fss_eirp=fss_tx_power_per_channel+fss_gain_theta;

fss_case=str2mat(terminal,signal,num2str(fss_bw_mhz),pattern,num2str

```

TELEDES.M

```
(elevation_angle));
fss_file=['T' t num2str(elevation_angle)];

return
```

```

function y=spaceway(terminal,signal,pattern,elevation_angle)

%terminal=subscriber
%
%signal=t1
%    1/2t1
%    1/4t1
%
%pattern=itu
%    supplied

global freq lambda step_size

global fss_name fss_file fss_el_angle fss_phi fss_tx_peak_gain
global fss_tx_gain fss_tx_power_per_channel fss_bw_mhz
global fss_gain_theta fss_eirp fss_case fss_power_control

fss_name='Spaceway';
fss_phi=0:step_size:180;

if strcmp(terminal,'subscriber')==1; t='L';
fss_tx_peak_gain=44.2;
fss_power_control=1.7;
if strcmp(pattern,'supplied')==1
    fss_tx_gain=
end
if strcmp(signal,'1/4t1')==1
    fss_bw_mhz=0.5;
    fss_tx_power_per_channel=-5.2;
end
if strcmp(signal,'1/2t1')==1
    fss_bw_mhz=1;
    fss_tx_power_per_channel=-2.2;
end
if strcmp(signal,'t1')==1
    fss_bw_mhz=2;
    fss_tx_power_per_channel=.8;
end
end

if strcmp(pattern,'itu')==1
    fss_tx_gain=gainitu(0,0,fss_tx_peak_gain,60,fss_phi);
end

fss_el_angle=elevation_angle;
fss_gain_theta=fss_tx_gain(elevation_angle/step_size+1);
fss_eirp=fss_tx_power_per_channel+fss_gain_theta;

fss_case=str2mat(terminal,signal,num2str(fss_bw_mhz),pattern,num2str
(elevation_angle));
fss_file=[ 'S' t num2str(elevation_angle)];

```

SPACEWAY.M

return

GAINITU.M

```

function y = gainitu(plot_flag,freq,ant_dia,eff,phi);

%gainitu returns an antenna pattern based
%on ITU document 9/160-E
%
%Call: gainitu(plot_flag,freq,ant_dia,eff,phi)
%
%where plot_flag = 1 linear x-axis plot
%           = 2 semilog x-axis plot
%           = otherwise do not plot
% freq     = frequency in GHz
% ant_dia  = antenna diameter in meters
% eff      = antenna efficiency, %
% phi      = range of angles in degrees
%
%Alternatively, if the antenna diameter is unknown,
%enter zero for the frequency and enter the peak
%antenna gain (dB) in place of the antenna diameter,
%e.g., g_a29_a3(1,0,56,60,phi)

if freq==0
    gmax=ant_dia;
    d_over_lambda=10^((gmax-10*log10(pi^2*eff/100))/20);
    freq='Not Given';
else
    lambda=.3/freq;
    d_over_lambda=ant_dia/lambda;
    ant_area=pi*(ant_dia/2)^2;
    gmax=10*log10(ant_area*eff/100*4*pi/lambda^2);
end

g1=2+15*log10(d_over_lambda);

if d_over_lambda>=100
    y=max(gmax-0.0025*(d_over_lambda.*phi).^2,min(g1,max(32-25*log10(phi),-10*ones(size(phi)))));
    backlobe=-10;
end

if d_over_lambda<100
    y=max(gmax-0.0025*(d_over_lambda.*phi).^2,min(g1,max(52-10*log10(d_over_lambda)-25*log10(phi),(10-10*log10(d_over_lambda))*ones(size(phi)))));
    backlobe=10-10*log10(d_over_lambda);
end

if plot_flag==1
    plot(phi,y)
    title('RR Appendix 29 Annex III Antenna Model')
    xlabel('Angle (degrees)')
    ylabel('Antenna Gain (dB)')

```

```

v=axis;
xpos=v(2)-v(1);
ypos=v(4)-v(3);
text(v(1)+.55*xpos,v(3)+.95*ypos,['Frequency = ',num2str(freq),' G
Hz'])
text(v(1)+.55*xpos,v(3)+.9*ypos,['Antenna diameter = ',num2str(ant
_dia),' meters'])
text(v(1)+.55*xpos,v(3)+.85*ypos,['d/lambda = ',num2str(d_over_lam
bda)])
text(v(1)+.55*xpos,v(3)+.8*ypos,['Peak gain = ',num2str(round(10*g
max)/10),' dB'])
text(v(1)+.55*xpos,v(3)+.75*ypos,['Back lobe = ',num2str(round(10*
backlobe)/10),' dB'])
end

if plot_flag==2
semilogx(phi,y)
title('RR Appendix 29 Annex III Antenna Model')
xlabel('Angle (degrees)')
ylabel('Antenna Gain (dB)')
v=axis;
axis([.1 180 v(3) v(4)]);
ypos=v(4)-v(3);
text(7,v(3)+.95*ypos,['Frequency = ',num2str(freq),' GHz'])
text(7,v(3)+.9*ypos,['Antenna diameter = ',num2str(ant_dia),' mete
rs'])
text(7,v(3)+.85*ypos,['d/lambda = ',num2str(d_over_lambda)])
text(7,v(3)+.8*ypos,['Peak gain = ',num2str(round(10*gmax)/10),' d
B'])
text(7,v(3)+.75*ypos,['Back lobe = ',num2str(round(10*(10-10*log10
(d_over_lambda))/10),' dB')])
end

return

```

```
function y=xx(fraction)
v=axis;
y=v(1)+fraction*(v(2)-v(1));
return
```

```
function y=yy(fraction)
v=axis;
y=v(3)+fraction*(v(4)-v(3));
return
```


ATTACHMENT M

ENTIRE RESULTS OF INTERFERENCE ANALYSIS IN 6.1 FSS EARTH STATIONS ACCESSING GSO SATELLITES INTERFERING INTO LMDS RECEIVERS

Protection Distance (ft) Case: 1 Teledesic into Videophone

Teledesic

Terminal: tst

Signal: t1

Bandwidth: 26.5

Pattern: itu

El. angle: 40

Videophone

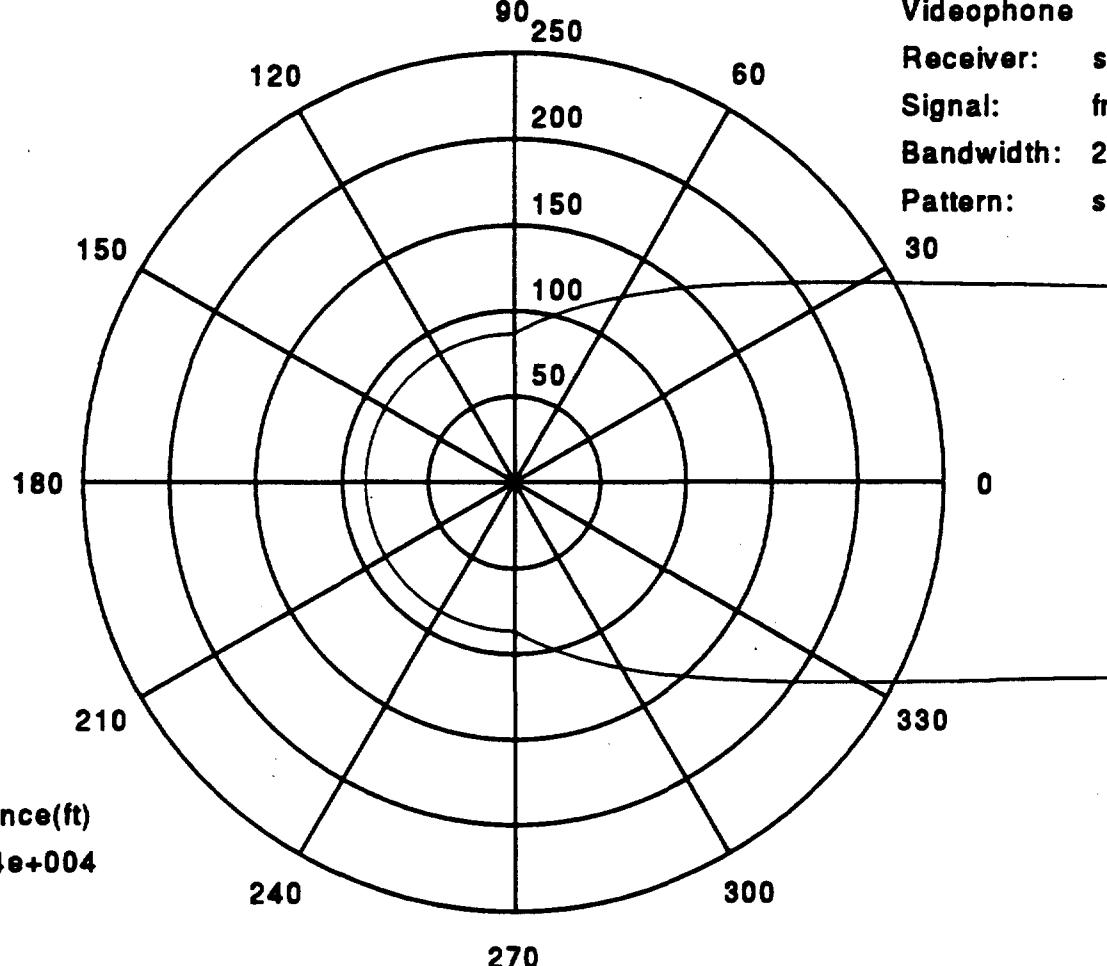
Receiver: subscriber

Signal: fm

Bandwidth: 20

Pattern: supplied

30



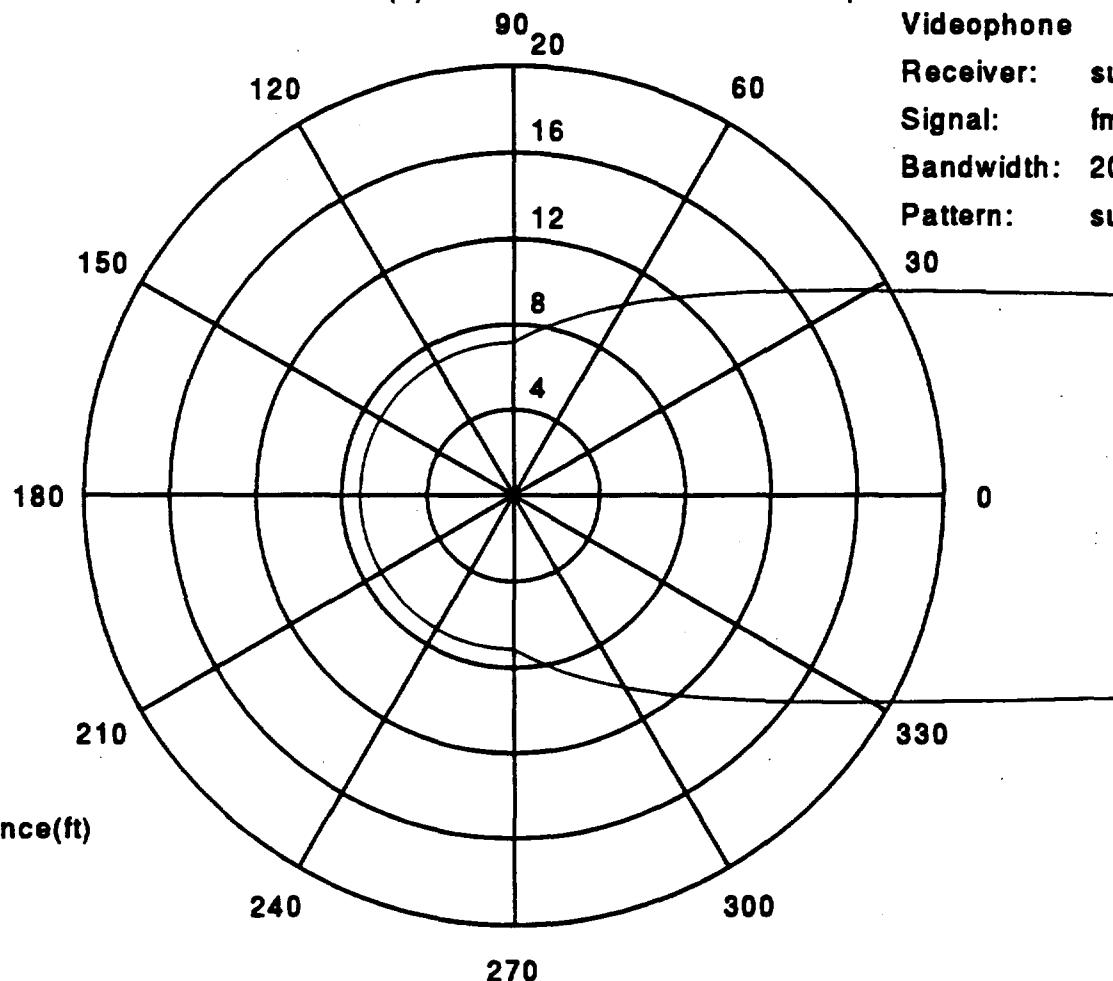
Protection Distance (ft) Case: 2 Teledesic into Videophone

Teledesic

Terminal: tgt
 Signal: oc24
 Bandwidth: 800
 Pattern: itu
 El. angle: 40

Videophone

Receiver: subscriber
 Signal: fm
 Bandwidth: 20
 Pattern: supplied



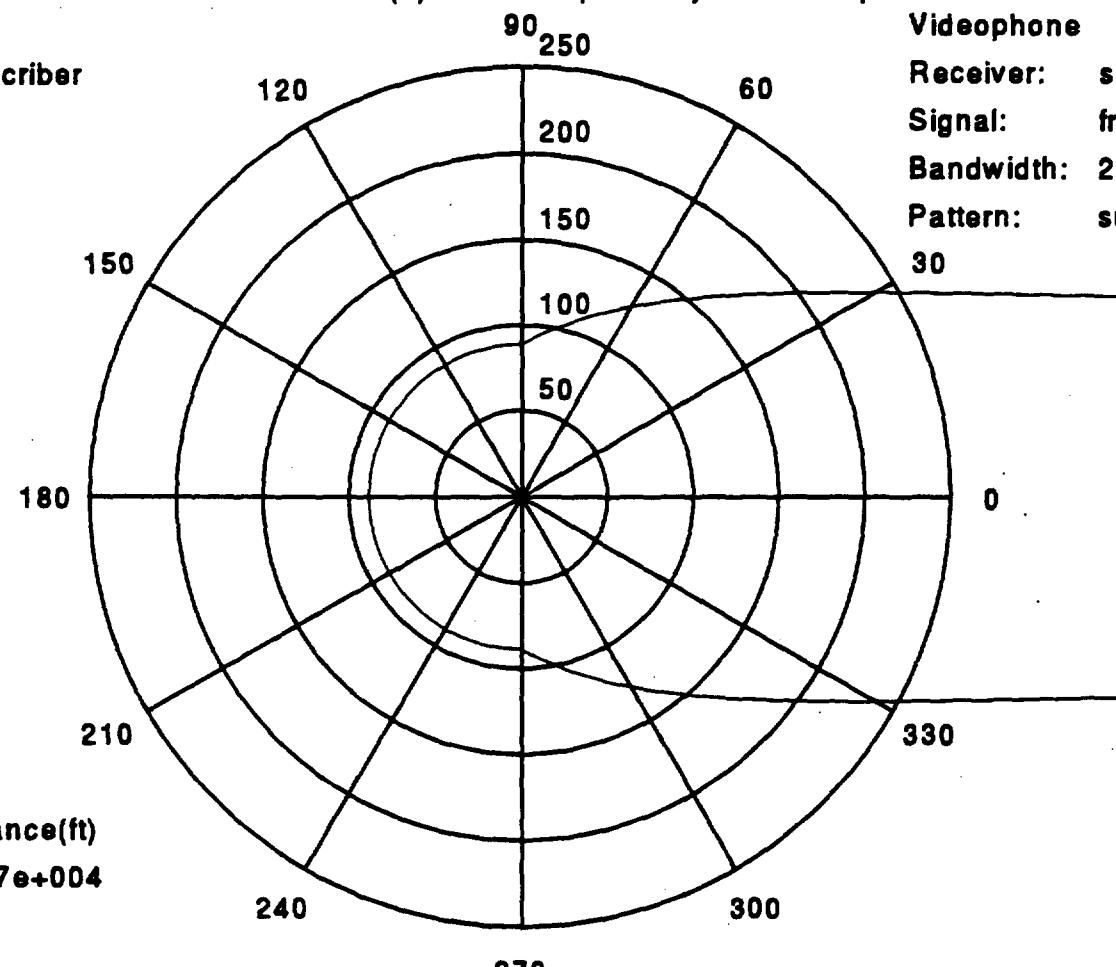
Protection Distance (ft) Case: 3 Spaceway into Videophone

Spaceway

Terminal: subscriber
 Signal: t1
 Bandwidth: 2
 Pattern: itu
 El. angle: 30

Videophone

Receiver: subscriber
 Signal: fm
 Bandwidth: 20
 Pattern: supplied
 El. angle: 30



Protection Distance (ft) Case: 4 Acts into Videophone

Acts

Terminal: usat

Signal: 4.8 kbps

Bandwidth: 0.0048

Pattern: supplied

El. angle: 30

Videophone

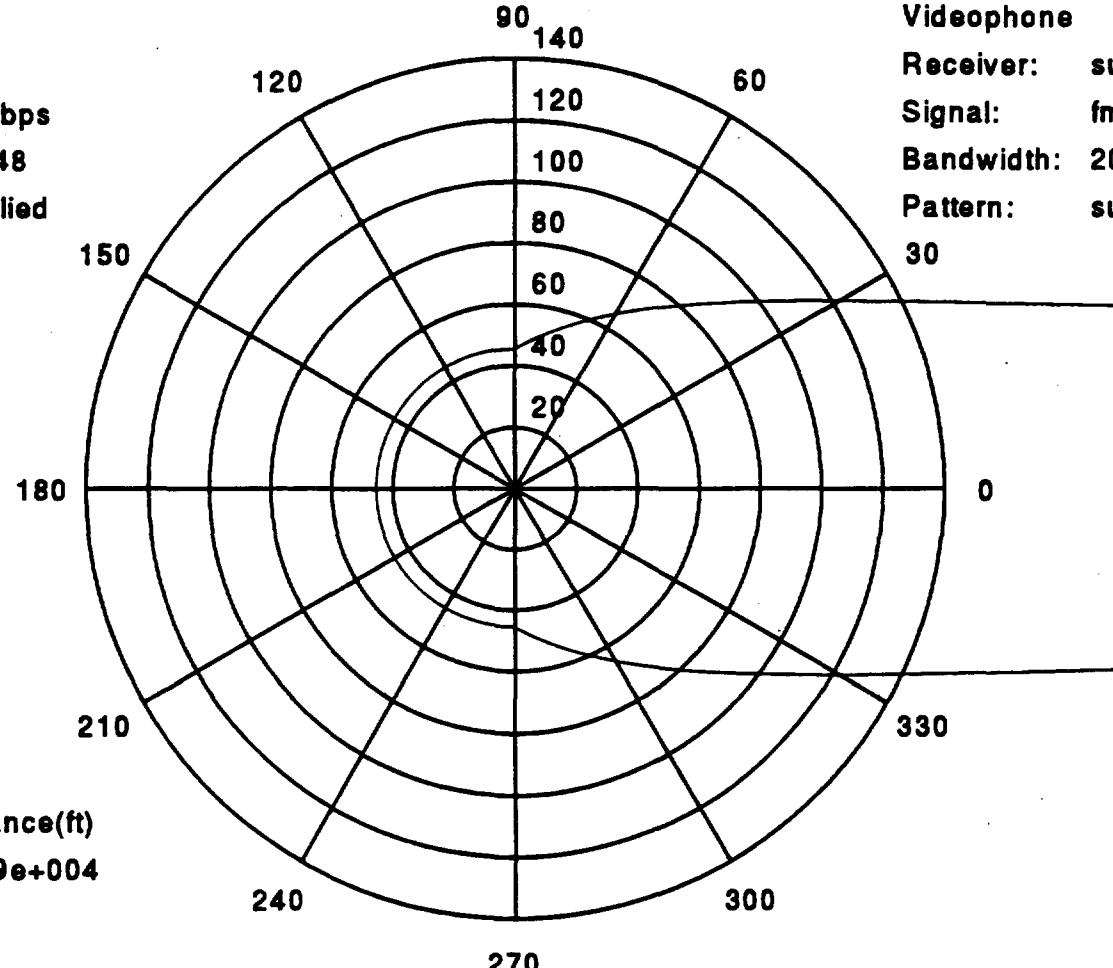
Receiver: subscriber

Signal: fm

Bandwidth: 20

Pattern: supplied

30



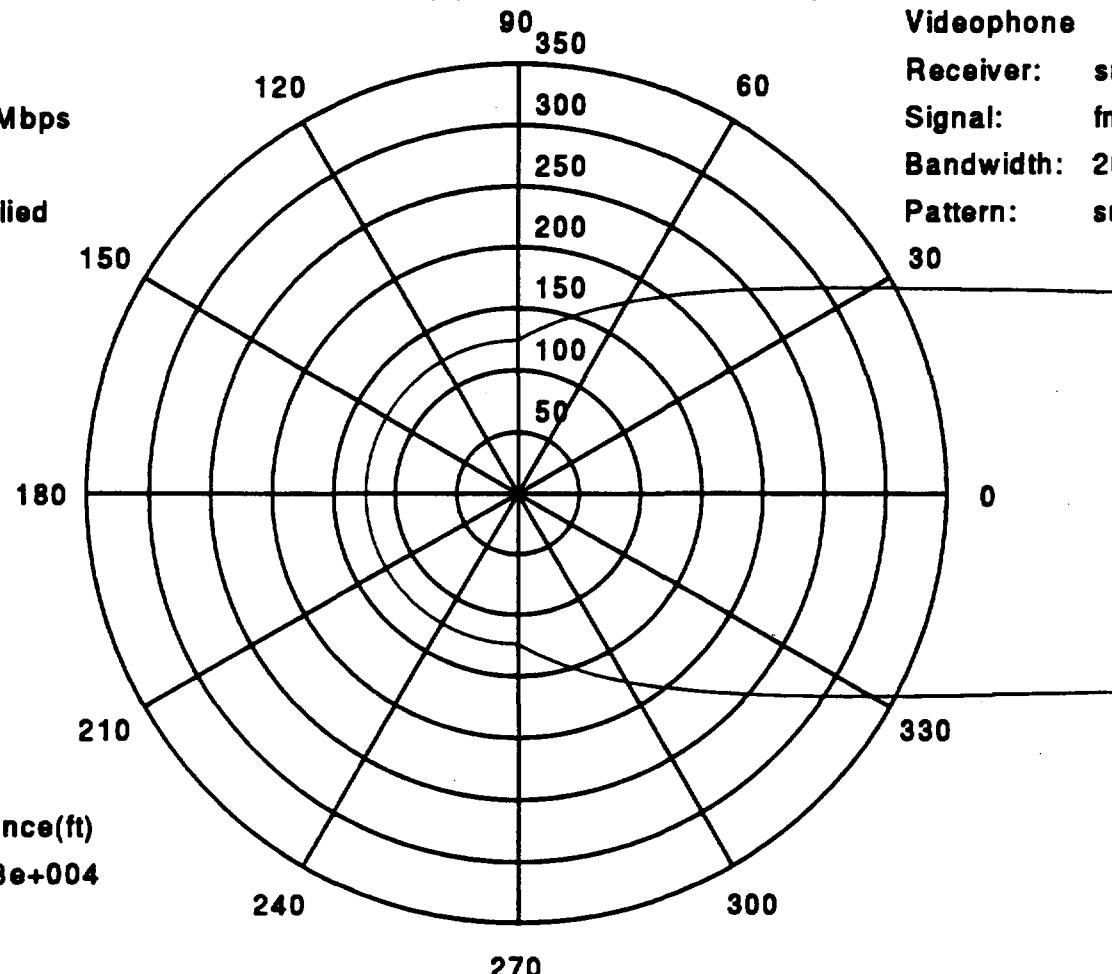
Protection Distance (ft) Case: 5 Acts into Videophone

Acts

Terminal: hdrt
 Signal: 622 Mbps
 Bandwidth: 900
 Pattern: supplied
 El. angle: 30 150

Videophone

Receiver: subscriber
 Signal: fm
 Bandwidth: 20
 Pattern: supplied
 30



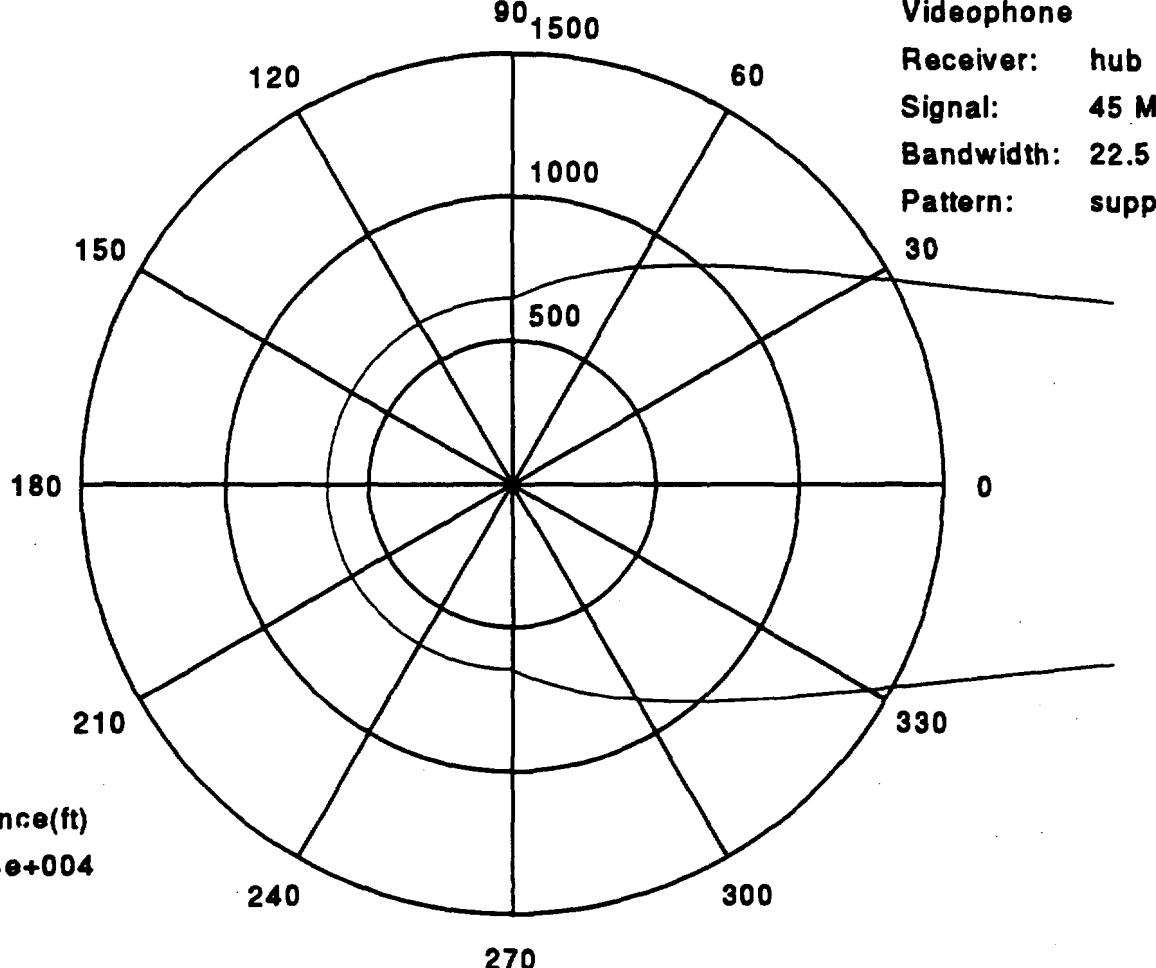
Protection Distance (ft) Case: 6 Teledesic into Videophone

Teledesic

Terminal: tst
 Signal: t1
 Bandwidth: 26.5
 Pattern: itu
 El. angle: 40

Videophone

Receiver: hub
 Signal: 45 Mbps
 Bandwidth: 22.5
 Pattern: supplied



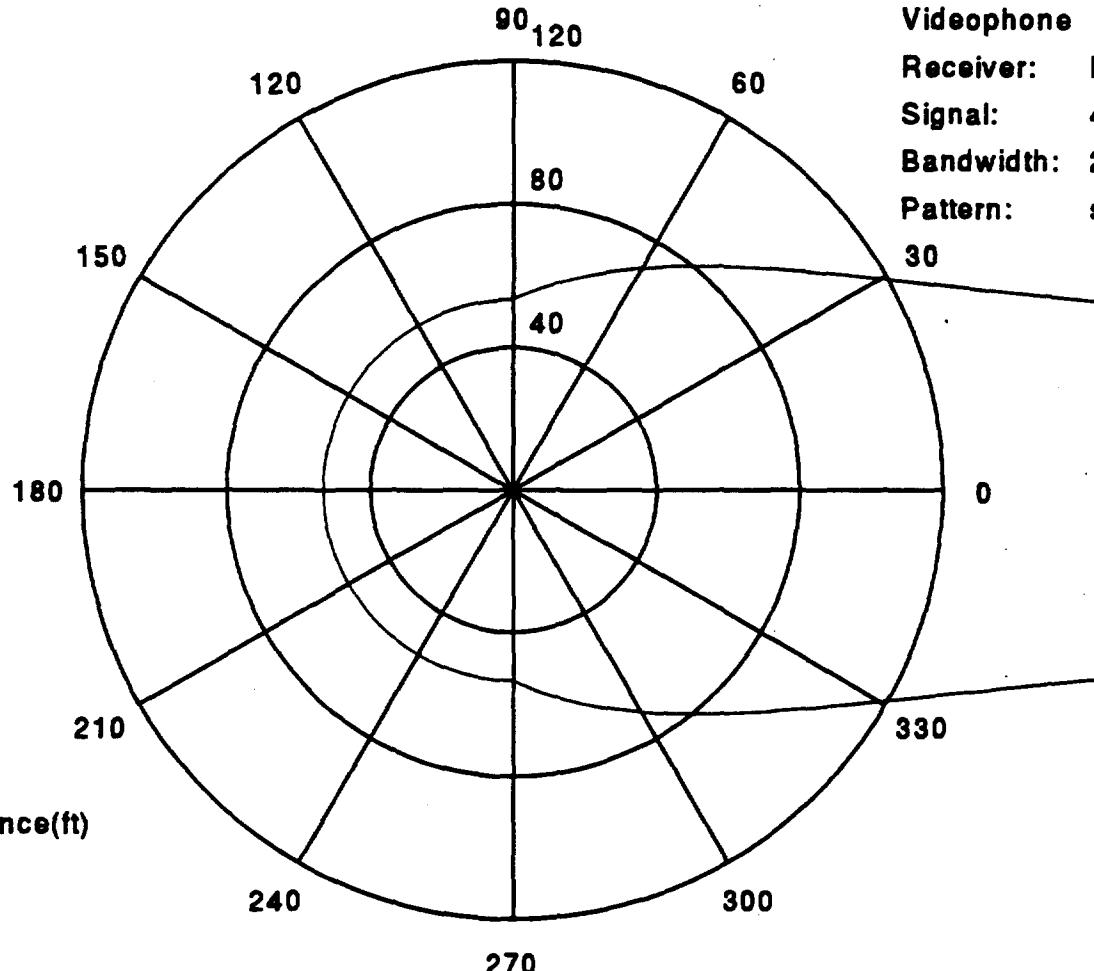
Protection Distance (ft) Case: 7 Teledesic into Videophone

Teledesic

Terminal: tgt
 Signal: oc24
 Bandwidth: 800
 Pattern: itu
 El. angle: 40

Videophone

Receiver: hub
 Signal: 45 Mbps
 Bandwidth: 22.5
 Pattern: supplied



Protection Distance (ft) Case: 8 Spaceway into Videophone

Spaceway

Terminal: subscriber

Signal: t1

Bandwidth: 2

Pattern: itu

El. angle: 30

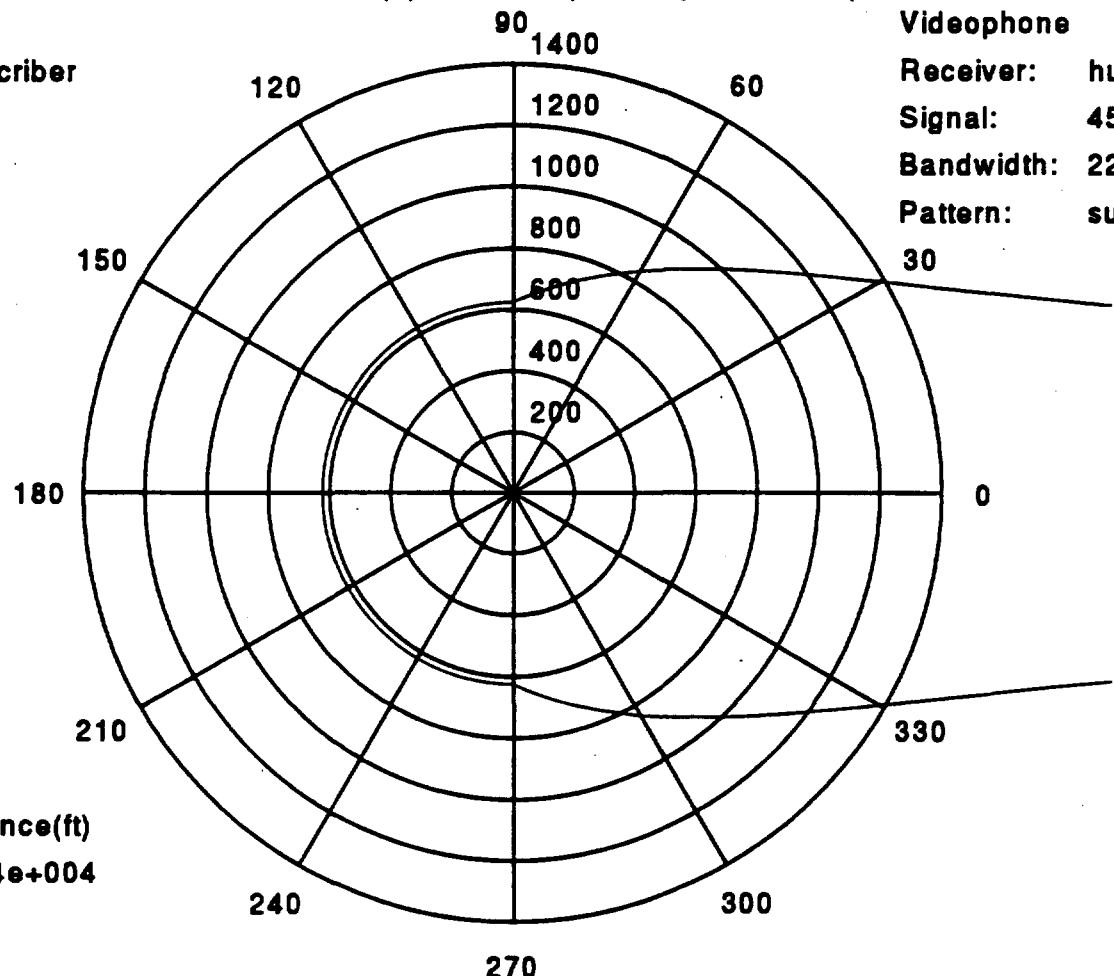
Videophone

Receiver: hub

Signal: 45 Mbps

Bandwidth: 22.5

Pattern: supplied



Protection Distance (ft) Case: 9 Acts into Videophone

Acts

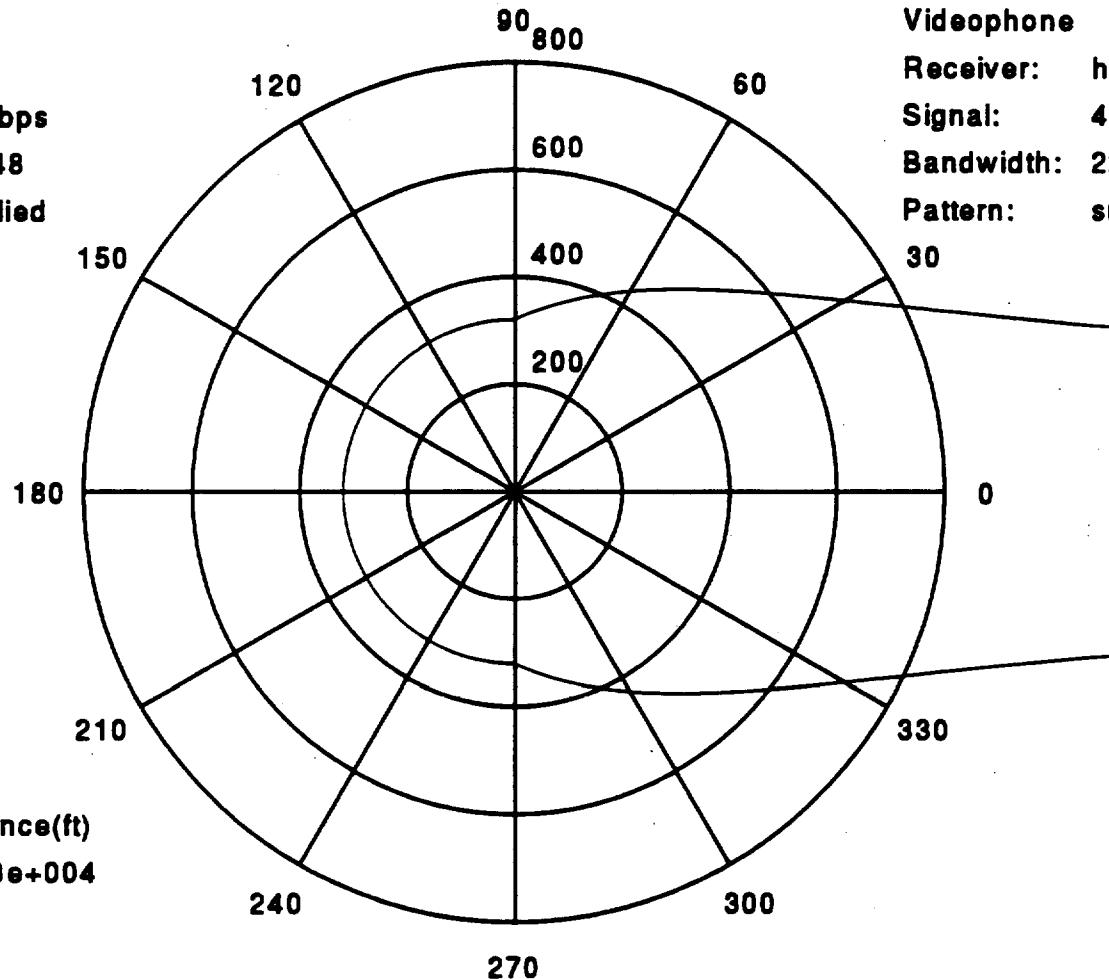
Terminal: usat
 Signal: 4.8 kbps
 Bandwidth: 0.0048
 Pattern: supplied
 El. angle: 30

Angle

Angle	Distance(ft)
0	2.643e+004
45	529
180	320

Videophone

Receiver: hub
 Signal: 45 Mbps
 Bandwidth: 22.5
 Pattern: supplied
 El. angle: 30



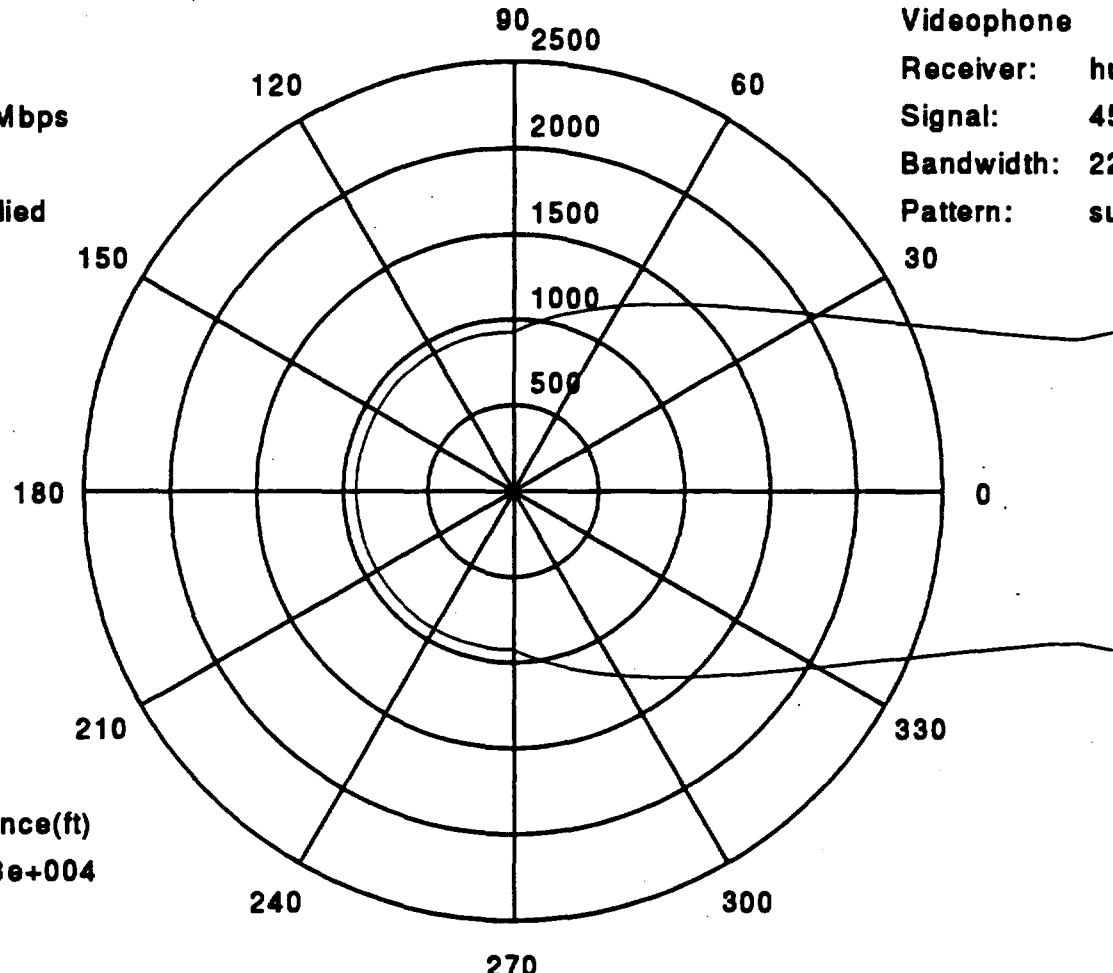
Protection Distance (ft) Case: 10 Acts into Videophone

Acts

Terminal: hdrt
 Signal: 622 Mbps
 Bandwidth: 900
 Pattern: supplied
 El. angle: 30

Videophone

Receiver: hub
 Signal: 45 Mbps
 Bandwidth: 22.5
 Pattern: supplied



Protection Distance (ft) Case: 11 Teledesic into Suite 12

Teledesic

Terminal: tst

Signal: t1

Bandwidth: 26.5

Pattern: itu

El. angle: 40

Suite 12

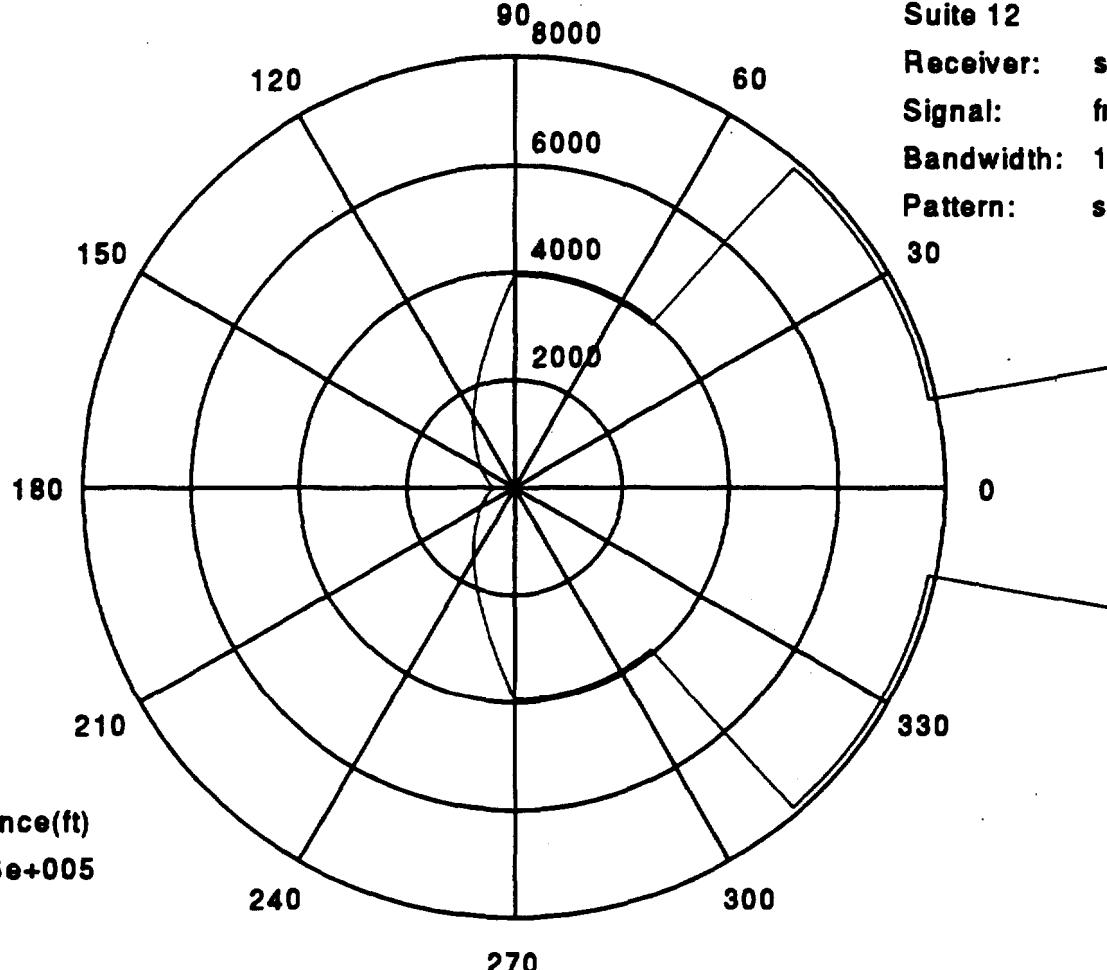
Receiver: subscriber

Signal: fm

Bandwidth: 18

Pattern: supplied

30



Protection Distance (ft) Case: 12 Teledesic into Suite 12

Teledesic

Terminal: tgt
 Signal: oc24
 Bandwidth: 800
 Pattern: itu
 El. angle: 40

Suite 12

Receiver: subscriber
 Signal: fm
 Bandwidth: 18
 Pattern: supplied
 30

